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Applications to Medicine and Hadrontherapy: Medical Applications of Particle Physics

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The development of radiation detectors in the field of nuclear and particle physics has had a terrific impact in medical imaging since this latter discipline took off in late '70 with the invention of the CT scanners. The massive use in Nuclear Physics and High Energy Physics of position sensitive gas detectors, of high Z and high density scintillators coupled to Photomultiplier (PMT) and Position Sensitive Photomultipliers (PSPMT), and of solid state detectors has triggered during the last 30 years a series of novel applications in Medical Imaging with ionizing radiation. The accelerated scientific progression in genetics and molecular biology has finally generated what it is now called Molecular Imaging. This field of research presents additional challenges not only in the technology of radiation detector, but more and more in the ASIC electronics, fast digital readout and parallel software.

In these two lectures I will try to present how Particle Physics and Medical Imaging have both benefited by the cross-fertilization of research activities between the two fields and how much they will take advantage in the future.

Summary

LECTURE #1 –Physics and Technology

- The physics of CT
- Clinical CT and MicroCT
- The Physics of PET
- The Technology of PET
- Hybrid Systems (PET-CT)
- Molecular Imaging (from man to mouse)
- Preclinical Systems
- Hybrid Systems (PET-MR)

LECTURE #2 –Applications

- Specific applications in clinical PET
- TOFPET
- PET in hadrontherapy
- Organ dedicated PET systems
- A novel technique: Cherenkov Imaging
- Conclusions

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